

Commercial Space Committee

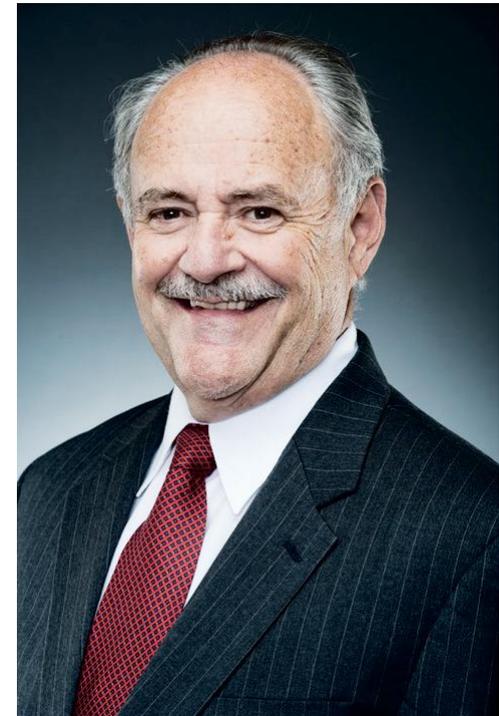
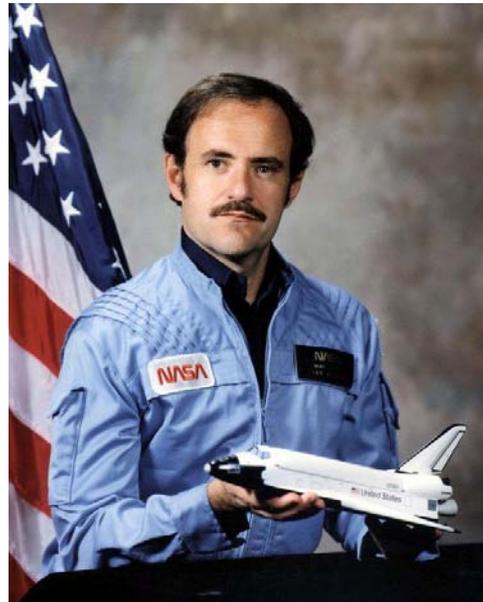
Update

Presented to the NASA Advisory Council

May 5, 2011

In Memoriam

- ▶ Commercial Space Committee member J. Michael Lounge passed away on March 1
 - ▶ NASA Astronaut
 - ▶ STS-51-L (1985), STS-26 (1988), STS-35 (1990)
 - ▶ US Navy officer and Vietnam war veteran
 - ▶ Executive at Spacehab and The Boeing corporation
 - ▶ Member, NASA Advisory Council Commercial Space Committee (2010-2011)



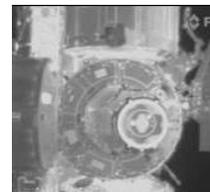
Meeting Schedule

- ▶ Commercial Committee meetings held:
 - ▶ February 16, 2010, at NASA Headquarters in Washington, DC
 - ▶ March 30, 2010, at NASA Headquarters
 - ▶ April 26, 2010, at Johnson Space Center
 - ▶ June 17, 2010, at NASA Headquarters
 - ▶ July 8, 2010, fact finding at Kennedy Space Center
 - ▶ July 29, 2010, at NASA Headquarters
 - ▶ September 13-14, 2010, at Johnson Space Center
 - ▶ September 14, joint meeting with NAC Space Operations Committee
 - ▶ December 14, 2010, at NASA Headquarters
 - ▶ Joint meeting with NAC Education & Public Outreach Committee
 - ▶ February 11, 2011, at NASA Headquarters
 - ▶ April 27, 2011, at NASA Headquarters

- ▶ Upcoming meetings:
 - ▶ August 2, 2011, at Ames Research Center

COTS Update

- ▶ 23 of 29 Milestones completed for a total of \$283M NASA payments
- Evaluating proposal for accelerating C3 mission objectives on C2 flight
- DragonEye II launched on STS-133
 - Preliminary LIDAR and Thermal Imager data collection was successful
- Performed mission sim with future ISS crew manipulating the Robotic Work Station – Dragon successfully berthed
- ▶ C2 F9 First Stage in Texas, completed static fires
- ▶ Second Stage delayed due to weld defects
- ▶ C2 Dragon in final assembly
- Final Augmentation mod under review
 - Complete TVAC, EMI, Acoustic test
 - Complete infrastructure enhancements
 - Powered Cargo improvement



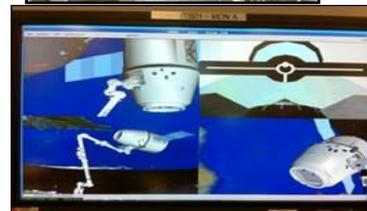
DragonEye II Thermal Imager



DragonEye II on STS-133



C2 Dragon capsule in assy



Dragon berthing sim with future ISS Crew



C2 F9-003 1st Stage Static
Fire



C2 F9-003 Second Stage

COTS Update (cont.)

 Current Plan
 Actual Completion Date

 Initial SAA Plan
 Projected

Milestones	\$M	\$M	2006		2007				2008				2009				2010				2011				2012				
			Total	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	278.0																												
1 Project Mgmt Plan	23.1	23.1		Sep 15																									
2 Demo 1 SRR	5.0	28.1			Nov 29																								
3 Demo 1 PDR	18.1	46.2				Feb 8																							
4 Financing Round 1	10.0	56.2					Mar 1																						
5 Demo 2 SRR	31.1	87.4						Mar 15																					
6 Demo 1 CDR	8.1	95.5							Aug 22																				
7 Demo 3 SRR	22.3	117.8								Oct 29																			
8 Demo 2 PDR	21.1	139.0									Dec 19																		
9 Draco Init. Hot fire	6.0	145.0										Mar 21																	
10 Financing Round 2	10.0	155.0											Mar 21																
11 Demo 3 PDR	22.0	177.0												Apr	Jun 27														
12 Multi-Engine Test	22.0	199.0													Aug 4	Sep													
13 Demo 2/3 CDR	25.0	224.0														Dec 18	Jan												
14 Financing Round 3	10.0	234.0														Feb 8	Mar												
15 Demo 1 RR	5.0	239.0							Feb								Mar									Jun 8			
16 CUCU Flight Unit	9.0	248.0															May										Jul 23		
17 Demo 1 Mission	5.0	253.0											Sep														Dec 15		
18 Demo 2 RR	5.0													Dec													Sep		
19 Demo 2 Mission	5.0														Jun													Nov	
20 Cargo Int. Demo	5.0	258.0																Dec 18										Jan	
21 Demo 3 RR	5.0															Jul												Dec	
22 Demo 3 Mission	5.0																Sep											Jan	

COTS Update (cont'd)

SpaceX Augmented COTS Milestones

Milestones	\$M	\$M	2007				2008				2009				2010				2011				2012			
	Total		Q1	Q2	Q3	Q4																				
	40.0																									
23 Modal Test Plan	5.0	5.0																								
24 Modal Test	5.0	10.0																								
25 LIDAR Test (open loop)	5.0	15.0																								
26 Solar Array Deploy Test	5.0	20.0																								
LIDAR Test Plan (closed loop)	5.0	25.0																								
28 Thermal Vacuum Test Plan	5.0																									
29 Infrastructure Plan	10.0																									
SAA Total	318.0	278.0																								



6 Current Plan Initial SAA Plan

Actual Completion Date Projected

COTS Update (cont'd)

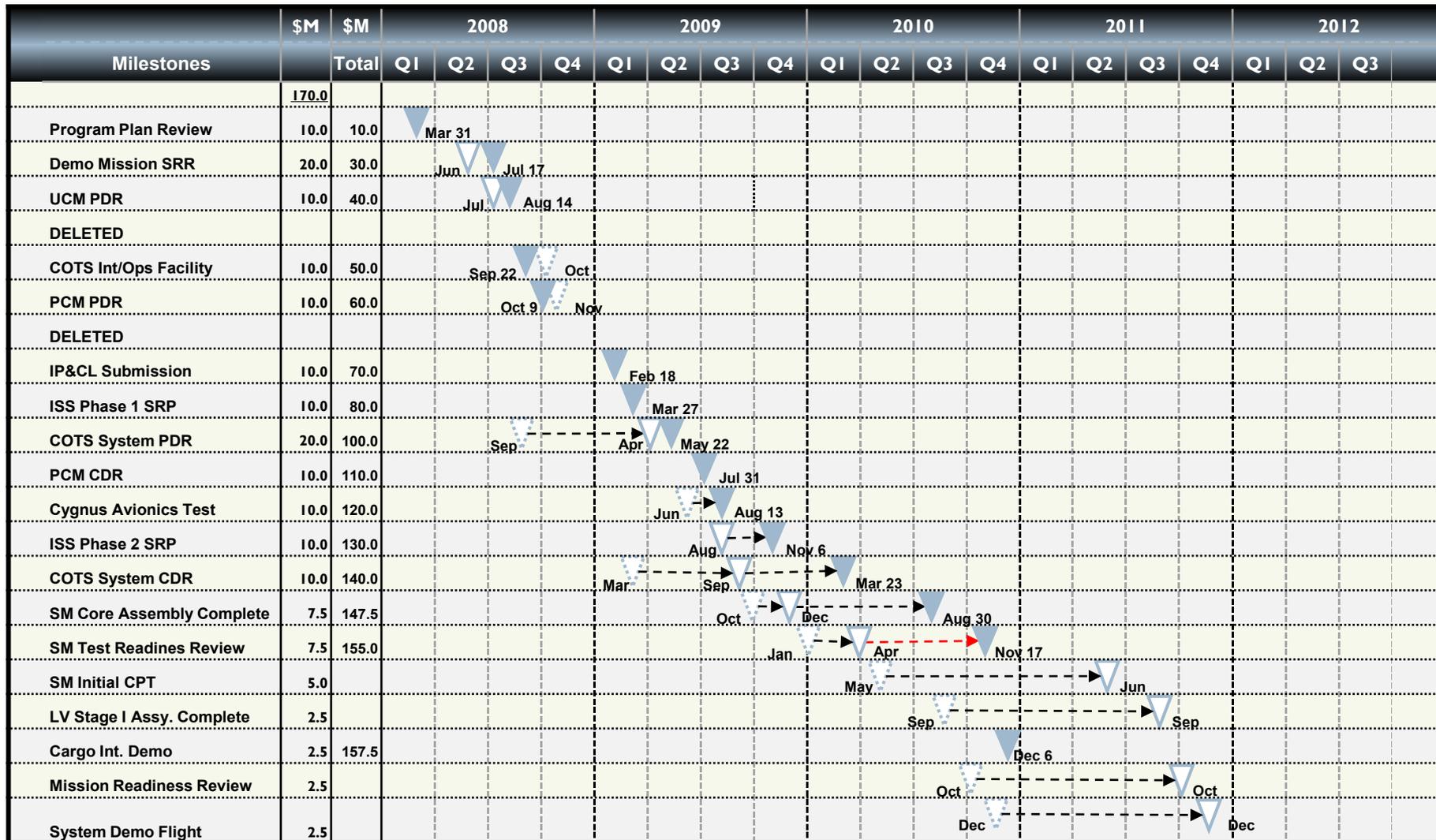
Orbital Recent Progress

- 18 of 29 total Milestones completed for a total of \$197.5M NASA payments
 - ◆ All Design reviews complete
 - ◆ Spacecraft & launch vehicle hardware being integrated & tested
 - ◆ ISS Phase II Safety Review Panel Complete
- SAA renegotiated to augment scope of SAA to include Taurus II Test Launch and other risk reduction activities with associated additional funding commitments from NASA & OSC
- Cygnus Spacecraft in assembly, integration & testing phase
 - PCM nearing completion & prepping for shipment from Italy
 - SM initiated system level integration & testing at OSC Dulles
- Taurus II hardware making major progress toward test launch & demo
 - 2 – 1st stage Cores delivered to WFF from Ukraine
 - 3 AJ-26s successfully tested at SSC & 2 delivered to WFF
- Wallops Flight Facility & MARS launch & integration facilities under construction



COTS Update (cont.)

Orbital COTS Milestones



Current Plan



Initial SAA Plan



8

Actual Completion Date



Projected

Commercial Crew Update

- ▶ **Authorization Bill:**
 - ▶ Establishes Commercial Crew as the “primary means” of transporting NASA astronauts to/from the International Space Station
 - ▶ Provides \$1.3 billion over three years for development of commercial capabilities
 - ▶ Sen. Nelson stated Commercial Crew would be “fully funded over 6 years” vs. 5 years, i.e. \$5.8 b
 - ▶ Requires publication of human rating requirements within 60 days, and reports to Congress on acquisition strategy and commercial markets prior to initiating full-up Commercial Crew Development Program

- ▶ **CCDev 1 (Commercial Crew Development)**
 - ▶ \$50 million in Recovery Act funding for Commercial Crew technology acceleration
 - ▶ 5 companies awarded Space Act Agreements (SAAs)
 - ▶ Sierra Nevada, United Launch Alliance, Blue Origin, Paragon Space Development Corp., Boeing

- ▶ **CCDev 2**
 - ▶ \$269 million awarded April 18 for “significant maturation of commercial crew systems”
 - ▶ 4 companies
 - ▶ Blue Origin (\$22 m), Boeing (\$92.3 m), Sierra Nevada (\$80 m), SpaceX (\$75 m)

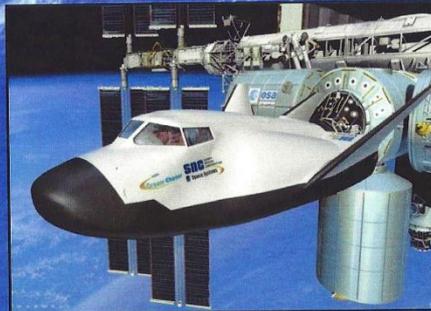
CCDev 2



Commercial Crew Development



Phase 2 Maturing Design Elements



CCDev 2 (cont.)

Participant Name	Work Summary	NASA Funding
Blue Origin	Space Vehicle design to SRR, pusher escape ground and flight testing, and engine pump and thrust chamber testing	\$22,005,000
Boeing	CST-100 design maturation to PDR and launch vehicle integration	\$92,300,000
Sierra Nevada Corporation	Dream Chaser crew transportation system design maturation to PDR and component testing	\$80,000,000
SpaceX	LAS engine design maturation and maturing design to a PDR including crew accommodation prototype	\$75,000,000
Total Funding		\$269,305,000



Back-up Charts



Observations / Findings / Recommendations

▶ Observations

- ▶ *Progress of the COTS Program* – “moving forward at a deliberate pace”

▶ Findings

- ▶ *Use of Space Act Agreements* – “is appropriate for the proposed Commercial Crew Transportation program “

▶ Recommendations

- ▶ *Defining the NASA Market* – “assess and clarify NASA’s expected traffic model”
- ▶ *Concept of Operations and Acquisition Approach* – “specify the minimum and maximum number of seats to and from the ISS NASA would purchase”
- ▶ *FAA Licensing* – “engage the FAA as soon as possible...with the goal of providing clarity to potential offerors regarding the regulatory framework “
- ▶ *Business Case* – “continue to develop internal metrics and milestones to oversee...Commercial Crew “
- ▶ *Public Outreach for Commercial Activities* – “encourage existing [COTS] contractors to work with NASA’s Office of Communication to integrate public outreach into mission planning and operations” and NASA draft a recommended commercial partner public outreach and participatory exploration policy

Work Plan (Draft)

1. Review and advise on how best to optimize NASA's organizational elements and address cultural issues to effectively encourage and promote the development of a commercial space industry.
2. Review NASA's strategy and plans for stimulating a commercial space industry, and provide advice on effective and appropriate methods for NASA to stimulate, encourage and partner with commercial space. What is the logical progression for developing a commercial capability for transportation to ISS and LEO?
3. Review and advise on NASA's strategy for partnering and cooperating with other federal agencies on commercial space.
4. Provide advice on how NASA should define "commercial space" to effectively implement "commercial space" programs and policies.

Definitions

▶ Observation

- ▶ Something seen, discovered, witnessed, or learned by the NAC committee during the course of fact-finding or public meetings
- ▶ A PASSIVE outcome or output
- ▶ Example: “The Committee discovered that there is an unfunded mandate that NASA must comply with in the area of X.”

▶ Finding

- ▶ An observation about which the NAC committee wishes to state an opinion
- ▶ A SEMI-ACTIVE outcome or output
- ▶ Example: “The Committee concurs with the current approach NASA is taking to do X.”

▶ Recommendation

- ▶ A course of action being proposed by the NAC committee for NASA consideration and/or implementation in the future
- ▶ An ACTIVE outcome or output
- ▶ Example: “The Committee recommends that NASA form a tiger team to address a critical issue in the area of X.”

Commercial Committee Members

- ▶ **Bretton Alexander, Chair**
 - ▶ President of the Commercial Spaceflight Federation
- ▶ **Lon Levin, Vice Chair**
 - ▶ Co-founder of XM Satellite Radio and other satellite businesses
- ▶ **Maj Gen Donald Hard (USAF, Ret.)**
 - ▶ Independent consultant to government and industry
- ▶ **Bernard A. Harris, Jr., (M.D.)**
 - ▶ CEO of Vesalius Ventures, former NASA astronaut, and former SPACEHAB executive
- ▶ **Patti Grace Smith**
 - ▶ Former FAA Associate Administrator for Commercial Space Transportation and consultant/advisor to space and aerospace companies
- ▶ **Wilbur C. Trafton**
 - ▶ Former NASA Associate Administrator for Space Flight and executive at ILS and Kistler Aerospace
- ▶ *John Emond, Executive Secretary*
 - ▶ *NASA Innovative Partnerships Program, Office of Chief Technologist*